

BEVERAGES AND THEIR PREPARATIONField of the Invention

The present invention relates to beverages, especially
5 beverages having a pH at or close to neutral and processes for
preparing them. The beverages may be in powder form for
conversion into a drink by the addition of a liquid.

Background of the Invention

10 At neutral or mildly acidic pH, protein used in instant
powdered drinks tends to sediment, due to poor dispersibility,
leading to phase separation and consumer perception of
chalkiness and sandiness. In order to produce stable acidic
foods, different stabilisers have been used to prevent
15 coagulation and precipitation of protein particles. At higher
concentrations of stabiliser, unwanted effects such as phase
separation, precipitation, etc are observed. In addition, all
stabilisers increase viscosity when used, and are therefore not
suited to the tastes of today's consumers who prefer low
20 viscosity and light food textures.

It is also known to granulate powdered soybean protein in a
fluidized bed agglomerator whilst spraying-on an aqueous
solution of carbohydrate, as disclosed in US-A-2002/146487 and
US-A-2003/124226.

25 Stabilisers such as carrageenan, sodium carboxymethylcellulose
(CMC-Na), propylene glycol alginate ester (PGA), water-soluble
soybean polysaccharides (SSP), and beet-derived pectin (BD-
pectin) have normally been used in ready-to-drink products,
either alone or in combination (including mixtures with other
30 polysaccharides) for production of ready-to-drink acidic

protein foods in order to prevent phase separation with resultant chalkiness and sandiness caused by protein particles. Thus, there remains a need to provide beverages around neutral pH or mildly acidic pH, which are either in liquid, drinkable
5 form or which can be made into a drinkable composition by dispersing in a liquid, the drinkable compositions having a low viscosity, preferably in the range of 5 to 50 mPas at a shear rate of 0.1 s^{-1} or at 10 s^{-1} beverages avoid the drawbacks of phase separation, chalkiness and sandiness due to the protein
10 particles.

Summary of the Invention

According to a first aspect of the invention there is provided a process for making a powdered precursor for preparing a
15 neutral or mildly acidic beverage upon admixture of the powdered precursor with a liquid, the process comprising the steps:

- (a) preparing a first slurry comprising a protein source and a polysaccharide stabiliser, said first slurry
20 having a neutral or mildly acidic pH;
- (b) adjusting the pH of the first slurry, if necessary, to a value in the range of from 5.5 to 7.5, preferably from 6 to 7.5, more preferably from 6 to 7; and
- 25 (c) spray drying the first slurry after step (a) or step (b).

According to a second aspect of the invention there is an acidic beverage made by the admixture of a liquid, preferably
30 an aqueous liquid and a powdered precursor made by the process

of the first aspect of the invention. An aqueous liquid is one which contains at least some water, preferably at least 10%, more preferably at least 25%, most preferably at least 50% by weight of water. The term also includes substantially pure
5 water such as tap water.

In a particularly preferred embodiment, the inventors have ground that the above-mentioned problems can be overcome by spray drying of solutions of proteins and stabilisers at nearly neutral or mildly acidic pH.

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Detailed Description of the Invention

The beverage powder precursors must be mixed with a liquid in order to form a composition which is suitable for a consumer to drink. Any suitable liquid can be used, but preferred examples
15 are water and milk. "Milk" also includes flavoured milk drinks. Preferably a second slurry is prepared comprising the protein source, a third slurry is prepared comprising the polysaccharide stabiliser and the second and third slurries are admixed to provide said first slurry.

20 As used herein, the term "neutral or mildly acidic" preferably means a pH from 5.5 to 8, more preferably from 6 to 7. In any range wherein the lower value is "from 6", this may be replaced by "from more than 6" or by "from 6.00001" or "from 6.01".

If the first slurry has a pH range outside the target range of
25 from 6 to 7.5 or outside the preferred target range of from 6 to 7, then before spray drying in step (c), in step (b) its pH is adjusted by conventional means.

The Protein Source

The protein source may comprise any specific type of protein,
30 e.g. animal, in particular dairy protein, or plant protein.

Preferably the protein source provides at least some plant protein, for example soy protein, pea protein or lupin protein, or mixtures thereof. These proteins can be intact or hydrolysed, and can be used separately or in combination with
5 each other.

The total amount protein to be used may be generally about 0.5 to 10 wt%, preferably 0.5 to 4 wt%, and preferably around 2.7 % wt (e.g. 4 g in a 150g serving) with respect to the final product.

- 10 In relation to the first slurry, the amount of protein source in the second slurry could for example be from 5 to 20wt%.

The Polysaccharide Stabiliser

A wide range of polysaccharides can be used as stabilisers,
15 particularly polysaccharide gums. However, preferred stabilisers are selected from locust bean gum, tamarind seed polysaccharide, gellan gum, xanthan gum, guar gum, tara gum, gum arabic, kalaya gum, carrageenan, agar soybean polysaccharides and mixtures thereof.

- 20 One or more auxiliary non-polysaccharide stabilisers may be used in addition to the polysaccharide stabiliser(s). In particular, preferred auxiliary stabilisers are glycol alginate esters, methoxy pectin (HM-pectin), sodium carboxymethylcellulose (CMC-Na), propylene glycol alginate
25 ester (PGA), and beet-derived pectin (BD-pectin). These may be used alone or in combination. The most preferred stabilisers are guar gums.

The amount of the stabiliser to be used may be generally about 0.05-10 % wt, and preferably 0.05 - 2 wt%, with respect to the
30 final beverage product, but these ranges do not restrict the scope of the invention because they may vary depending on

differences in the protein concentration. The weight ratio of protein:stabiliser is preferably from 5:1 to 50:1 more preferably from 10:1 to 30:1.

The amount of stabiliser in the first slurry is preferably from 0.02 to 20 wt%, e.g. 5 to 20 wt%.

With regard to the third slurry, the amount of stabiliser in the third slurry is preferably from 0.1 to 20 wt%, preferably from 0.1 to 3 wt%.

10 Carbohydrate

Preferably, carbohydrate is included in the first slurry, most preferably introduced via the protein source-containing second slurry. Preferred carbohydrates include sugars, starches, and maltodextrin.

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Other Ingredients

The powder preferably further contains emulsifier, organic acid (such as lactic, malic or citric) and oil fat and is fortified with minerals, vitamins, etc. Once dispersed in a liquid such as water or milk, the drink is preferably stable against coagulation and phase separation for at least 30 minutes.

Product Form

The powdered precursor may be one adapted to make any desired neutral or mildly acidic beverages, upon addition of a suitable liquid such as water or milk.

For the spray drying operation, the feed may be a stable solution of the ingredients with a dry matter content between 10 and 50%, preferably between 30 and 40% (m/m). This slurry is

spray dried in a so-called spray-drier, resulting in fine particulate matter. A spray dryer is a system where the feed liquid is atomised by means of any type of atomiser, i.e. rotary, two or one phase nozzle, and subsequently dried to form 5 particulate matter. Where the particle size is between 5 and 400 μm , eg between 5 and 100 μm . To produce a dry powder, the spray tower is preferably operated at a temperature of from 150 to 250°C, depending on the dry matter content and tower loading (mass flow ratio slurry to air). The resulting powder will be 10 typically hydrophobic. Due to its fineness and hydrophobicity the material is typically difficult to disperse in water without lump formation. An additional agglomeration or granulation step increases the particle size of each particle. The initial particle will have a $d_{4,3}$ average particle diameter 15 of from 5 μm to 100 μm , e.g. from 5 μm to 35 μm whereas the preferred $d_{4,3}$ average particle size ex granulator lies preferably between 50 and 600 μm , more preferably between 150 and 400 μm . This improve the dispersibility so far that it can be easily use in a powdered drink mix, where the spray-dried 20 powder is used, in a mixture with other powders. The agglomeration preferably takes place in a fluid bed type of agglomerator, like a Fielder-Aeromatic type. The binder fluid is preferably plain water. It is advantageous to agglomerate a mixture of the spray-dried material with a carbohydrate like 25 sucrose or maltodextrin or an easily dissolving salt. Alternatively any other type of agglomerator can be used, e.g.:

- high shear mixer granulator e.g. Schugi type granulator or Loedige ploughshare type,
- pressure granulators, e.g. Bepex basket extruder type 30 granulators, or
- steam granulators.

The most favourable technique is the use of a combined spray-drier/fluidised bed system, where the powder from the spray drier is directly granulated. Such a system would be for
5 example a Fluidized Spray Dryer or a Multistage Spray Dryer form GEA Niro A/S. The agglomeration could be just due to the remaining cohesiveness of the powder due to steam treatment or water spray on, with or without addition of easily water soluble material as binder. Such material would be
10 carbohydrates, salts or polymers known as binder.

The addition of lecithin can improve the wetability and dispersability of the powder.

The present invention will now be explained in more detail by way of the following non-limiting examples. Throughout these
15 examples, the parts and percentages are based on weight unless otherwise specified.

Examples

20 As analytical methods viscosimetry, particle sizing and phase separation measurements were used. The used methods will be explained in the following chapter.

The viscosity was tested in a cone-plate geometry of a
25 rotational rheometer. Temperature was set to 20°C. The data are taken from the down curve of a flow curve hysteresis. 10 1/s and 50 1/s were chosen as relevant shear rates.

The stability of the beverages was tested by measuring the
30 phase-separated volume in a cylinder as well as visually. When

visually clear flocs were determined the system was classified as unstable.

The surface weighted volume mean diameters $D_{3,2}$ and $D_{4,3}$ of the particles in the beverage were determined by laser diffraction to get a value for sandiness.

The amount of unstable dispersed mater was measured by centrifugation of the final product for 20 minutes at 2800 g and 20°C. The percentage of the sediment (sediment/total mass x 100) was measured after 5 minutes of dripping out the water.

Examples 1 - 4

These examples comprise, respectively, preparation of four powdered beverage precursors by spray drying and agglomeration.

The used material was a standard spray dried skim milk powder as source for a milk protein. The used spray dried was in this case a Niro Mobile Minor. The soy protein originates from a soy protein isolate: FXP 219 D ex Solae, as pea protein Pisane HD NO5 ex Cosucrua was used. The stabiliser are: Blanose 7LF ex Hercules (SCMC 7), k-Carragenan (Genugel X-0909 ex CP Kelco), Vidocreame A type of guar gum ex Unipektin (guar). The used maltodextrin is a DE 12 maltodextrin ex Rouquette (Glucidex IT 12).

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Table 1: Examples with different proteins and stabilisers.

Example		1	2	3	4
Protein source		soy	soy	pea	soy/SMP
Type		k-Carraghenan	SCMC 7	Guar	Guar
Protein powder	SMP	0.0%	0.0%	0.0%	16.9%
	Soy	30.0%	30.0%	22.4%	28.7%
	Pea	0.0%	0.0%	0.0%	0.0%
Maltodextrin	MD12	69.4%	62.0%	76.0%	52.8%
Citric acid	CA	0.0%	4.0%	0.0%	0.0%
Biopolymer	Stabiliser	0.6%	2.0%	2.0%	1.6%
T in	[°C]	159	160	161	160
T out	[°C]	83	83.7	81.9	80
Total solids content in final product	%	10%	20%	20%	20%
pH		7.02	5.6	5.89	6.7
D3,2 wet 5 min.	micron	0.26	5	20.7	0.35
D4,3 wet 5 min.	micron	9.4	12.1	50	58.3
Phase separation 15 min.	%	0	0	0	0
Stable after 15min.		yes	slightly flocculated	yes	yes
Phase separation 45 min.	%	0	0	1	0
Stable after 45min.		yes	slightly flocculated	yes	yes
eta 10 1/sec. 5min	mPas	28	30	35	31
eta 50 1/sec. 5min	mPas	22	28	34	29
Centrifugation	%	13.6	22	35	7.7

Example 4 is agglomerated in a so-called multistage drier, where a fluid bed is integrated in the spray tower. It was possible to disperse the agglomerated powder by adding it to water and by stirring the mass for 20 seconds with a spoon.

5 This shows that the powder has good instant properties. The non-agglomerated samples (1-3) showed less ideal instant properties and they were dispersed shortly by a blender type of equipment for 15 sec.

10 Reference samples were produced for comparison to the above examples.

Table 2: Reference samples

Example		Ref 1	Ref 2	Ref 3	Ref 4
Protein source		Soy	Soy	Pea/Guar	Soy/Guar
Protein powder	SMP	0.0%	0.0%	0.0%	0.0%
	Soy	30.0%	30.0%	0.0%	30.0%
	Pea	0.0%	0.0%	25.0%	0.0%
Maltodextrin	MD12	70.0%	67.0%	75.0%	70.0%
Citric acid	CA	0.0%	3.0%	0.0%	2.0%
Biopolymer		0.00%	0.0%	2.00%	2.00%
Total solids content in final product	%	20.0%	20.0%	20.0%	20.0%
pH		7.08	5.5	6.01	6.99
D3,2 wet 5 min.	micron	13.3	5.5	27.1	0.7
D4,3 wet 5 min.	micron	21.7	25.5	85	149.6
Phase separation 15 min.	%	1	0	0	1
Stable after 15min.		yes	slightly flocculated	yes	yes
Phase separation 45 min.	%	10	0.5	2	10
Stable after 45min.		slightly flocculated	slightly flocculated	yes	slightly flocculated
eta 10 1/sec. 5min	mPas	9.5	58	61	246
eta 50 1/sec. 5min	mPas	10.5	29	61	360
centrifugation	%	19.5	36.7	32.9	6.6

Claims

1. A process for making a powdered precursor for preparing a neutral or mildly acidic beverage upon admixture of the powdered precursor with a liquid, the process comprising the steps:

- (a) preparing a first slurry comprising a protein source and a polysaccharide stabiliser, said first slurry having a neutral or mildly acidic pH;
- (b) adjusting the pH of the first slurry, if necessary, to a value in the range of from 5.5 to 7.5, preferably from 6 to 7.5, more preferably from 6 to 7; and
- (c) spray drying the first slurry after step (a) or step (b).

2. A process according to claim 1, wherein a second slurry is prepared comprising the protein source, a third slurry is prepared comprising the stabiliser and the second and third slurries are then mixed to form said first slurry.

3. A process according to either preceding claim, wherein carbohydrate is added to at least one slurry, preferably the second slurry as recited in claim 2.

4. A process according to any preceding claim, wherein the polysaccharide stabiliser is selected from locust bean gum, tamarind seed polysaccharide, gellan gum, xanthan gum, guar gum, tara gum, gum arabic, kalaya gum, carrageenan, agar soybean polysaccharides and mixtures thereof.
5. A process according to any preceding claim, further comprising the step of subjecting the slurry or any or all slurries to a heat treatment, preferably in the range of from 40°C to 80°C.
6. A process according to any preceding claim, further comprising the step of homogenising the slurry or any or all of the slurries.
7. A process according to any preceding claim, further comprising agglomerating the spray dried product of step (c).
8. A process according to any preceding claim, wherein in step (a) the first slurry has a pH above the isoelectric point of the protein, preferably a pH above 6.
9. A process according to claim 2, wherein the stabiliser in the third slurry is neutral or is negatively charged.
10. A process according to any preceding claim, wherein the protein source comprises a plant protein, animal protein or mixtures thereof.

11. A process according to claim 10, wherein the plant protein is selected from soy protein, pea protein or lupin protein or mixtures thereof, and/or the animal protein is selected from dairy protein.

12. A process according to claim 2, wherein the amount of stabiliser in the third slurry is from 0.01 to 20 wt %, preferably from 0.1 to 20 wt%.

13. A process according to any preceding claim wherein in step (d) one or more further ingredients are added to the mixture of slurries, these ingredients preferably being selected from fat, emulsifiers and organic acids.

14. A neutral or mildly acidic beverage made by the admixture of a liquid, preferably an aqueous liquid and a powdered precursor made by the process of any preceding claim.

15. A neutral or mildly acidic beverage according to claim 14, which contains stabiliser at a level of from 0.05 to 10 wt%.

16. A neutral or acidic beverage according to claim 14 or claim 15, which contains protein at a level of from 0.5 to 10 wt%.

17. A neutral or mildly acidic beverage according to any of claims 14 - 16, which has a viscosity of from 5 to 50 mPas at a shear rate of 0.1 s^{-1} or of 10 s^{-1} .